

# PATENT SPECIFICATION

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## (54) TOBACCO SMOKE FILTER

(71) I, EIICHIRO NAKATSUKA, a citizen of Japan, residing at No. 23-15, Kohinata, 1-chome, Bunkyo-ku, Tokyo, Japan, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to tobacco smoke filters. More particularly, it concerns specially coated powdered additives for such filters which will remove deleterious materials from tobacco smoke without removing the desirable smoke vapors that impart aroma and taste to the smoke.

Many cigarette filters have been developed for effectively removing tars and nicotine present in the tobacco smoke in order to protect a smoker's health. In some arrangements, a rod of synthetic or natural fibers forming a fibrous tow is employed which removes such deleterious materials by passing the tobacco smoke therethrough. However, it has been found that with such a fibrous tow a filtration efficiency of only 30 to 35 percent is available and also an unpleasant smell which is characteristic of fibers employed is added to the smoke to the detriment of the tobacco smoke. To eliminate these disadvantages, an activated carbon powder has been incorporated in the fibrous tow, with the resulting increase of the filtration efficiency to approximately 43 percent. However, in this instance, the nondeleterious volatile vapors which have a natural flavor of tobacco leaves as well as flavors of aromatic flavorings added thereto are also absorbed by the carbon powder so that a smoker's enjoyment is considerably lessened.

The present invention consists in a tobacco smoke filter for selectively removing deleterious materials including tars and nicotine present in the tobacco smoke, comprising a carrier medium arranged to provide interstices for the passage of smoke therethrough and having dispersed therein particulate vegetable oil encapsulated with a coating of water soluble polyvinyl alcohol or polyvinyl pyrrolidone.

[Price 25p]

Thus an additive is applied to cigarette filter tow to selectively remove deleterious materials such as tars and nicotine from the vapor phase of tobacco smoke. 50

The present invention utilizes the discovery that vegetable oils have the property of absorbing the vapors containing tars and nicotine and, when applied to a tobacco smoke filter, provide for a remarkable increase of tar and nicotine filtration efficiency without detriment of the tobacco taste. Vegetable oils which have been found particularly useful according to this invention include castor oil, cotton seed oil, maize, sunflower oil, sesame oil, soybean oil, rape oil or mixtures of these. The vegetable oils are processed so that the particles thereof are encapsulated with coatings of water-soluble polyvinyl alcohol or polyvinyl pyrrolidone. 55  
The encapsulation or coating of the vegetable oil particles is performed by adding, for example, 2 kg. of castor oil to 5 kg. of a solution consisting of 40 parts 25 percent polyvinyl alcohol (2000 degrees of polymerization) or polyvinyl pyrrolidone (low polymerization degree), 30 parts maize starch having an average particle size of 3 microns and 30 parts water. 60  
The prepared solution is emulsified by a conventional emulsifier. After 1 kg. of water has been added to the solution thus emulsified, it is spray-dried by a spray dryer to remove the water remaining in the castor oil particles thus leaving a dry castor oil powder encapsulated with a 75 percent polyvinyl alcohol or polyvinyl pyrrolidone coating, based on the dry weight of the powder, and having an average particle size of 0.6 micro. The coated vegetable oil particles are normally carried on a fibrous type filter medium and may be applied thereto by a vibrating device. However, any other suitable method of evenly dispersing such particles onto a filter tow may be employed. Also, cigarette filters may be made by positioning a mass of such coated vegetable oil particles between filter cylinders made of filaments. The fibrous type filter medium may be comprised of cotton, paper, wood pulp, cellulose acetate, polyesters or polyolefins. 65  
70  
75  
80  
85  
90

The vibrating device comprises a pan containing the coated vegetable oil particles and which is placed directly above and parallel to a crimped tow. The vibrator pan is adjusted to apply a desired amount of the additive and the additive is vibrated onto the tow as it moves through a cigarette filter-making machine. If desired, an adhesive or plasticizer can be added to the tow prior to the application of the coated vegetable oil particles. As the tow containing the additive moves through the filter-making machine, the tow is formed into a cylindrical rod and wrapped with a plug-wrapping paper. This cylindrical rod may be cut into many segments having a suitable length. The segments are attached to cigarettes by any suitable means.

In use, the smoke from the burning cigarette is passed through the filter containing the vegetable oil particles which have been prepared. Since polyvinyl alcohol or polyvinyl pyrrolidone is water soluble, the coating of the material on the particles is dissolved by the moisture in the smoke, so that the surfaces of the particles are exposed to the flow of the tobacco smoke. The exposed surfaces of the vegetable oil particles adsorb substantial amount of tars and nicotine contained in the smoke. The filter has also been found effective in removing from tobacco smoke those deleterious pungent volatile bases with a high molecular weight such as pyridine, while permitting the vapors containing essential oils that have a low molecular weight and render the tobacco taste milder, to readily pass therethrough. Further, it has been found that after the polyvinyl alcohol or polyvinyl pyrrolidone coatings

have been dissolved the vegetable oil particles penetrate the fibers of the filter element, so that as the cigarette is gradually smoked the draw becomes easier, that is, the pressure drop across the filter decreases. Thus, it will be understood that a large amount of such coated vegetable oil particles can be applied to the filter tow to add to the filtration efficiency.

The invention will be further described with reference to the following example.

#### Example

A 102-mm. length of 4 denier/filament crimped cellulose acetate fiber tow which had 43,000 filaments was spread out. Glyceryl triacetate (triacetin) in the amount of 6.5 to 7.0 percent by weight of the tow was applied to the tow by spraying. A castor oil powder which contained approximately 75 percent by weight of polyvinyl alcohol coated on its surface was applied to the tow from a vibrating pan. The tow was formed into a cylindrical rod and wrapped with a plug-wrapping paper. The cylindrical rod thus formed, which has a diameter of 7.9-mm., was then cut into 17-mm. segments. The 17-mm. segments, which contained approximately 45 mg. of coated vegetable oil particles, were attached to cigarettes. The cigarettes were smoked with an automatic smoking device, and the vapors which passed through the filter were collected and analyzed. These values are shown in Table below. Also shown in the Table are the amounts of these vapors obtained from the filters of this type containing 60, 80 and 100 mg. of castor oil powder, and the conventional filters containing an activated carbon powder and with no such additives applied thereto.

TABLE

Type 17-mm. filter	Percent tar removed by the filter	Percent nicotine removed by the filter
Acetate fibers with 45 mg. castor oil particles	59.0	41.0
Acetate fibers with 60 mg. castor oil particles	62.1	43.7
Acetate fibers with 80 mg. castor oil particles	63.4	57.4
Acetate fibers with 100 mg. castor oil particles	71.8	68.7
Acetate fibers with 45 mg. activated carbon powder	40	38
Acetate fibers without such additives	33	30

As will be apparent from the Table, the vegetable oil coated filter is much more effective than the uncoated filter in selectively removing deleterious materials such as tars and nicotine from tobacco smoke.

It will be appreciated that this invention should not be restricted to cigarettes, but that it could equally be applied to filters for synthetic tobacco.

WHAT I CLAIM IS:—

1. A tobacco smoke filter for selectively removing deleterious materials including tars and nicotine present in the tobacco smoke, comprising a carrier medium arranged to provide interstices for the passage of smoke there-through and having dispersed therein particulate vegetable oil encapsulated with a coating of water-soluble polyvinyl alcohol or polyvinyl pyrrolidone.

2. A tobacco smoke filter as claimed in Claim 1, in which said vegetable oil comprises at least one of castor oil, cotton seed oil, maize oil, sunflower oil, sesame oil, soybean oil, and rape oil.

3. A tobacco smoke filter as claimed in Claim 1 or 2, in which said carrier medium comprises cotton, paper wood, pulp, cellulose acetate, polysters or polyolefins.

4. A tobacco smoke filter substantially as herein described with reference to the foregoing example.

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